w

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/608,091	06/30/2003	Robert J. Steger	015290-682	8130

7590 01/25/2008

BURNS, DOANE, SWECKER & MATHIS, L.L.P.
P.O. Box 1404
Alexandria, VA 22313-1404

EXAMINER	
DHINGRA, RAKESH KUMAR	

ART UNIT	PAPER NUMBER
1792	

MAIL DATE	DELIVERY MODE
01/25/2008	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/608,091	Applicant(s) STEGER, ROBERT J.	
	Examiner Rakesh K. Dhingra	Art Unit 1792	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE _03_ MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on _29 October 2007_.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☐ Claim(s) _1-3,5-29 and 31-33_ is/are pending in the application.

4a) Of the above claim(s) _13,14 and 24 -29,31_ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) _1-3,5-12,15-23,32 and 33_ is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on _07 September 2006_ is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _10/07_.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☐ Other: _____.

DETAILED ACTION

Response to Arguments

Applicant's arguments, filed 10/29/07 with respect to the rejection(s) of claim(s) 1-12 and 15-23 under 35 USC 103 (a) have been fully considered and following comments are furnished:

Applicant has amended claims 1, 5, 6, 15, 17 (for example claim 1 has been amended by adding limitation– "a source of temperature controlled liquid in flow communication with the at least one flow passage; and a controller operable to control the volumetric flow rate and/or the temperature of the liquid circulated through the at least one flow passage, so as to control heating and cooling of the heat transfer member at a rate of from about 0.25-2°C/sec".

Further, applicant has cancelled 4 and 30 and added new claims 32, 33.

Accordingly claims 1-3, 5-29 and 31-33 are now pending out of which claims 1-3, 5-12, 16-23, 32 and 33 are active.

Response to applicant's arguments is given hereunder.

A. Claims 1, 2, 4, 7, 9, 10 and 12 -Applicant's argument that cited combination (Yatsuda, Tamura, Ramanan, Kadatoni I and Yang do not disclose amended claim limitation "liquid -----circulated to heat and cool " or "control heating and cooling of the heat -----" is rendered moot since applicant has changed claim limitation "heat and/or cool" to "heat and cool" and added new limitation regarding the controller controlling the heating and cooling from about 0.25 – 2 degrees C/sec. Applicant has also argued that Yatsuda, Tamura, Ramanan and Yang do not disclose heating and cooling rate limitation of about 0.25 -2 degrees C/sec.

Examiner responds that new reference by Chiang et al teaches both heating and cooling of substrate (that is heat transfer member) by a controller 74 that controls the temperature and flow rate of liquid coolant that flows through a passage 78 in the heat transfer member 110. Further, Ramanan also teaches that that the controller can be agile enough to control and achieve the heating and cooling rates of 1 degree C/sec to 50 Degrees C/sec (as against claim limitation of 0.25- 2 degrees C/sec) . It would be

obvious to configure the controller to achieve the desired heating and cooling rate as per process limitations in view of teaching of Ramaman et al and Chiang et al. Thus Yatsuda in view of Chiang et al and Ramanan et al teach all limitations of claim 1 as explained below. Applicant's argument regarding Kadatoni I not teaching cooling rate of 0.25 -2 degrees C/sec is rendered moot due to changed ground of rejection of claim 1 as explained above.

B. applicant's argument pertaining to claims 3, 5, 8, 11, 15-23 are rendered moot due to changed ground of rejection of claim 1 as explained above. In regards to applicant's argument against claim 9 that Mimura discloses a refrigerant area 17 for cooling but does not disclose that support table 2 is heated by flowing a liquid through refrigerant area 17, examiner responds that Chiang already teaches heating and cooling of heat transfer member by flowing a liquid whose temperature and flow rate are controlled as per claim limitation and Mimura is cited only for its teaching pertaining to ceramic ring overlying the ceramic member etc as also explained below. Thus claims 3, 5, 8, 9, 11 and 15-23 have also been rejected as explained below.

C. Further, new claims 32, 33 have also been rejected under 35 USC 103 (a) as explained below.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1, 2, 10, 12, 15, 16, 21 and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yatsuda et al (US Patent No. 6,488,863) in view of Chiang et al (US Patent 6,800,173) and Ramanan et al (US patent No. 6,529,686).

Regarding Claims 1, 2, 15, 16: Yatsuda et al teach a substrate support for plasma processing comprising:

a ceramic member 20;

a metallic heat transfer member 18 (made from aluminum) overlying the ceramic member 20 and including cooling flow passage 34 through which a coolant can be circulated to control temperature of the wafer W;

an electrostatic chuck 28 overlying the heat transfer member 18 and having a support surface for supporting a substrate W in a reaction chamber 16 of a plasma processing apparatus (column 3, lines 15-65). Though Yatsuda et al do not explicitly teach source of temperature controlled liquid, a coolant source would be obviously provided in the apparatus to enable supply the coolant through flow passage 34 to the heat transfer member 18.

Yatsuda et al teach a coolant is circulated through the heat transfer member but do not explicitly teach: a liquid coolant is circulated to heat and cool the heat transfer member, a source of temperature controlled liquid in flow communication with the at least one flow passage; and

a controller operable to control the volumetric flow rate and/or the temperature of the liquid circulated through the at least one flow passage, so as to control heating and cooling of the heat transfer member at a rate of from about 0.25-2°C/sec. Further, Yatsuda et al also do not teach the heat transfer member having a maximum thickness of about ¼ inch.

However use of liquid as a coolant for temperature controlled substrate holders for plasma processing apparatus is known in the art as per reference cited hereunder. Further, though Yatsuda et al do not explicitly disclose, the flow/temperature of coolant is normally controlled to obtain desired

temperature control of the heat transfer member (would involve cooling as well as heating of the heat transfer member) as per reference cited hereunder.

Chiang et al teach a temperature controlled electrostatic chuck assembly comprising an electrostatic chuck assembly 6 and a heat transfer member 110 having coolant (water) flow passages 78. Chiang et al further teach a source of temperature controlled fluid 76 and controller 330 that is operable to control the volumetric rate flow rate and/or temperature of the coolant liquid so as to control heating and/or cooling of the substrate 8 (that is, also of the heat transfer member) [e.g. Figs. 27, 28 and col. 21, line 38 to col. 22, line 36].

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to provide a controller that is operable to control the volumetric rate flow rate and/or temperature of the coolant liquid circulated through coolant flow passage as taught by Chiang et al in the apparatus of Yatsuda et al to provide precise control of temperature of the heat transfer element.

Yatsuda et al in view of Chiang et al do not teach heat transfer member having a maximum thickness of about ¼ inch and the controller enables control of heating and cooling of heat transfer member at a rate of from 0.25 – 2 degrees C/sec. .

However, thickness of heat transfer member is related to its thermal mass and it would be obvious to select thickness of the heat transfer member to obtain a desired thermal response during processing of a substrate, as per reference cited hereunder.

Ramanan et al teach a wafer processing apparatus (Figures 1a-1c) comprising:

a low thermal mass conductive heating member 20 for heating a wafer 12 in a chamber 16. Ramanan et al further teach that the thickness and diameter of heating member are related to thermal mass of the heating member. Ramanan et al further teach that for efficient and rapid heating/cooling of a workpiece, the heating member should have low thermal mass and high thermal conductivity. Ramanan et al also teach that as an example, for a low thermal mass ceramic heating member with a diameter ranging from 8-13 inch, the thickness can be less than ½ inch and preferably from about 0.06 to 0.25 inch and

having thermal mass varying from 500-2000 joules/C (col. 8, line 15 to col. 9, line 13). Thus thickness of heating member is a result effective variable that can be optimized to obtain a desired thermal mass, required as per process limitations. Though Ramanan et al do not explicitly teach metallic heating member (heat transfer member), his teaching could be applied to determine its optimum thickness as per process limitations like wafer size etc. Further, Ramanan also teaches that the controller can be agile enough to achieve the heating and cooling rates of 1 degree C/sec to 50 Degrees C/sec (as against claim limitation of 0.25- 2 degrees C/sec – which is a functional limitation) . It would be obvious to configure the controller to achieve the desired heating and cooling rate as per process limitations like type of coolant, flow rate of coolant etc, in view of teaching of Ramaman et al and Chiang et al. Further, since the apparatus of prior art meets the structural limitations of the claim the same is considered capable of meeting the functional limitations.

In this connection courts have ruled:

1) "It is well settled that determination of optimum values of cause effective variables such as these process parameters is within the skill of one practicing in the art. *In re Boesch*, 205 USPQ 215 (CCPA 1980)."

2) Claims directed to apparatus must be distinguished from the prior art in terms of structure rather than function. *In re Danly*, 263 F.2d 844, 847, 120 USPQ 528, 531 (CCPA 1959). Apparatus claims cover what a device is, not what a device does *Hewlett-Packard Co. V. Bausch & Lomb Inc.*, 15USPQ2d 1525, 1528 (Fed. Cir. 1990)

Regarding Claims 10, 21: Yatsuda et al teach an RF power source 48 electrically connected to the worktable 18 (heat transfer member) through a lead line 44 {Figure 1}.

Regarding Claims 12, 23: Yatsuda et al discloses a plasma processing apparatus comprising the substrate support of Claim 1 (Fig. 1).

Claims 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over Yatsuda et al (US Patent No. 6,488,863) in view of Chiang et al (US Patent 6,800,173) and Ramanan et al (US patent No. 6,529,686) as applied to claims 1, 2, 10, 12, 15, 16, 21 and 23 and further in view of Kadotani et al (US PGPUB No. 2004/0163601).

Regarding Claim 3: Yatsuda et al in view of Chiang et al and Ramanan et al teach all limitations of the claim except coolant flow passage dimensions.

Kadotani et al teach an apparatus (Figures 1, 7) that includes a substrate support for supporting a wafer W and having an electrode block 1 (heat transfer member) with coolant flow passages 11, 12. Kadotani et al further teaches that dimensions of coolant passages are related to heat transfer from the coolant to the electrode block (heat transfer member). Thus coolant flow passage dimensions would be result effective variable that could be optimized for the requirede heat transfer rate as per process limitations like flow rate, type of coolant etc. Further, though Kadotani et al apparatus uses a heat transfer gas, his teachings could be used for optimizing flow passage dimensions where a liquid is used in place of gas coolant, since use of both gas and liquid coolants in plasma processing apparatus is known in the art [for example, paragraphs 0077].

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to control (optimize) coolant flow passage dimensions (result effective variable), as taught by Kadotani et al in the apparatus of Yatsuda et al in view of Chiang et al and Ramanan et al for achieving required heat transfer rate between coolant and the heat transfer member, as per process limitations like type of coolant, coolant flow rate etc.

In this connection courts have ruled:

"It is well settled that determination of optimum values of cause effective variables such as these process parameters is within the skill of one practicing in the art. *In re Boesch*, 205 USPQ 215 (CCPA 1980)."

Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Yatsuda et al (US Patent No. 6,488,863) in view of Chiang et al (US Patent 6,800,173) and Ramanan et al (US patent No. 6,529,686) as applied to claims 1, 2, 10, 12, 15, 16, 21 and 23 and further in view of Kadotani et al (US PGPUB No. 2001/0018828).

Regarding Claim 5: Yatsuda et al in view of Chiang et al and Ramanan et al teach all limitations of the claim except the source of temperature controlled liquid includes a Peltier cooler operable to change the temperature of the liquid to a selected temperature.

Kadotani et al teach an apparatus for fluid temperature control (Figure 1) for comprising:

A fluid passage 25 for flowing the fluid whose temperature is to be controlled (fluid can be water or ethylene glycol etc);

Cooling pipes 9 for flow of cooling liquid (water or refrigerant); and

Thermo-electric elements 7 (peltier elements) that absorb the heat from the fluid and discharge the same to cooling liquid (abstract and paragraphs 0040-0043, 0052).

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to use peltier (thermoelectric) devices as taught by Kadotani et al in the apparatus of Yatsuda et al in view of Chiang et al and Ramanan et al for accurately controlling temperature of cooling liquid over a wide temperature range.

Claims 6, 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yatsuda et al (US Patent No. 6,488,863) in view of Chiang et al (US Patent 6,800,173) and Ramanan et al (US patent No. 6,529,686) as applied to claims 1, 2, 10, 12, 15, 16, 21 and 23 and further in view of Yang et al (US 6,635,580).

Regarding Claims 6, 17: Yatsuda et al in view of Chiang et al and Ramanan et al teach all limitations of the claim including a heat transfer gas source 52 operable to supply a heat transfer gas between the support surface and the substrate 8 (Chiang et al – Fig. 6), but do not teach the controller is

operable to (i) control the flow rate and/or pressure of the heat transfer gas supplied between the support surface and the substrate.

Yang et al discloses an apparatus for wafer processing comprising a temperature control apparatus 60 that includes a substrate support 62 that supports a wafer 46, a heat transfer gas source 32 that supplies heat transfer gas between substrate support 62 and the substrate through inlet conduit 64, a MFC 34, a manometer for pressure sensing and a controller 80 that control the flow rate and pressure of the heat transfer gas source supplied between the support surface and the substrate (for example, Fig. 3 and col. 6, lines 25-50).

Therefore it would have been obvious to a person of ordinary skill in the art at the time of the invention to provide a heat transfer gas between the substrate support and the substrate and a controller operable to control pressure and flow rate of the heat transfer gas as taught by Yang et al in the apparatus of Yatsuda et al in view of Chiang et al and Ramanan et al to efficiently control wafer temperature by using a feedback control system for controlling the supply of heat transfer gas.

Claims 7, 18 is rejected under 35 U.S.C. 103(a) as being unpatentable over Yatsuda et al (US Patent No. 6,488,863) in view of Chiang et al (US Patent 6,800,173) and Ramanan et al (US patent No. 6,529,686) as applied to claims 1, 2, 10, 12, 15, 16, 21 and 23 and further in view of Tamura et al (US PGPUB 2001/0009178).

Regarding Claims 7, 18: Yatsuda et al in view of Chiang et al and Ramanan et al teach all limitations of the claim except the heat transfer member comprises a base including the at least one flow passage and a cover overlying the base.

Tamura et al teach a wafer holding device (Figure 9) comprising a heat transfer member 2 with liquid coolant flow passages 42 and where the heat transfer member can be made in two parts that is, a base 53 including at least a flow passage and a cover 52 overlying the base (for example, Figs. 9, 15 and para. 0100).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to use a two-part heat transfer member having a base with at least a flow passage and an overlying cover as taught by Tamura et al in the apparatus of Yatsuda et al in view of Chiang et al and Ramanan et al for ease of manufacturing by making in two parts, due to complex shape of the base having flow passages.

Claims 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Yatsuda et al (US Patent No. 6,488,863) in view of Chiang et al (US Patent 6,800,173) and Ramanan et al (US patent No. 6,529,686) as applied to claims 1, 2, 10, 12, 15, 16, 21 and 23 and further in view of Mahawili (US patent No. 6,007,635).

Regarding Claim 8: Yatsuda et al in view of Chiang et al and Ramanan et al teach all limitations of the claim including ceramic member 20 includes a recessed surface and a flange, and the heat transfer member 18 is disposed on the recessed surface, and further the electrostatic chuck 28 contacts the flange of the ceramic member 20 (Yatsuda et al – Figure 1).

Yatsuda et al in view of Chiang et al and Ramanan et al do not teach heat transfer member is laterally spaced from the flange and the thickness of ceramic member at the recessed surface is about 1-4 mm.

Though Yatsuda et al do not teach that worktable (heat transfer member) 18 is laterally spaced from the flange, but it would be obvious to provide such lateral spacing to allow for thermal expansion between the heat transfer member 18 (made from aluminum) and the ceramic member 20 at the high processing temperatures during wafer processing (examiner notes that applicant has not disclosed any criticality for such a gap). A supporting reference (by Mahawili) is also cited hereunder.

Mahawili teaches a substrate support apparatus (Fig. 1) that includes a heater housing 22 with a support surface 21 in which a platform 10 (heat transfer member) is seated. Mahawili further teaches that heater housing 22 and platform 10 could be made from dissimilar materials like ceramic and aluminum

respectively. Mahawili also teaches that support surface 21 of heater housing 22 is sized to permit unrestrained thermal expansion of platform 10 (that is, platform 10 is spaced from ceramic heater housing). Mahawili additionally teaches that recess depth of support surface 21 is sized so that substrate when seated in platform 10 is flush with the upper surface 22b of heater housing 22 {column 4, line 1 to column 5, line 20}. Thus, it would be obvious to optimize the depth of recess can be optimized (like a result effective variable) as per process limitations, like wafer thickness.

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to provide a spacing between the heat transfer member and the ceramic member, and optimize ceramic member thickness at the recessed surface as taught by Mahawili in the apparatus of Yatsuda et al in view of Chiang et al and Ramanan et al to allow for thermal expansion between the heat transfer member (metallic) and the ceramic member, as per process limitations.

In this connection courts have ruled:

"It is well settled that determination of optimum values of cause effective variables such as these process parameters is within the skill of one practicing in the art. *In re Boesch*, 205 USPQ 215 (CCPA 1980)."

Claims 9, 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yatsuda et al (US Patent No. 6,488,863) in view of Chiang et al (US Patent 6,800,173) and Ramanan et al (US patent No. 6,529,686) as applied to claims 1, 2, 10, 12, 15, 16, 21 and 23 and further in view of Mimura et al (US Patent No. 7,022,616) and Tamura et al (US PGPUB 2001/0009178).

Regarding Claim 9: Yatsuda et al in view of Chiang et al and Ramanan et al teach all limitations of the claim except a ceramic ring overlying the ceramic member and surrounding the heat transfer member and the electrostatic chuck, the heat transfer member being laterally spaced from the ceramic ring, the electrostatic chuck contacting the ceramic ring.

Mimura et al teach a plasma apparatus (Figure 1) comprising a ceramic ring 5 overlying an insulating member 3 (normally made from ceramic) and surrounding a support table 2 (heat transfer member) and an electrostatic chuck 6 that is in contact with the ceramic ring 5 (e.g. Fig. 1 and col. 3, lines 5-65). Though Mimura et al do not explicitly teach the heat transfer member being laterally spaced from the ceramic ring, it would be obvious to provide such a clearance for thermal expansion considering the different coefficients of thermal expansion of the ceramic ring and the heat transfer member (made from metal), as per reference cited below (Tamura et al).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention use a ceramic ring that contacts and surrounds an electrostatic chuck as taught by Mimura et al in the apparatus of Yatsuda et al in view of Chiang et al and Ramanan et al to enable shield the electrostatic chuck from deposition by the reaction products.

Tamura et al teach a wafer holding device (Figure 9) comprising a heat transfer member 2 with liquid coolant flow passages 42 and where the heat transfer member can be made in two parts (Figure 15) {that is, metallic member 52 with coolant passages 42 and a holding member 53} which can then be joined together. Tamura et al further teach use of liquid coolant for flowing through coolant passages 42 (Figures 9, 15) and a heat transfer gas source operable to supply a heat transfer gas between the support surface and the substrate. Tamura et al further teach a ceramic ring 36 (susceptor) overlying the ceramic member 40 and surrounding the heat transfer member 2 that is laterally spaced from the ceramic ring (e.g. Fig. 9 and para. 0081-0083).

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to provide a lateral spacing between the heat transfer member and the ceramic ring as taught by Tamura et al in the apparatus of Yatsuda et al in view of Chiang et al, Ramanan et al and Mimura et al to provide for thermal expansion between heat transfer member and the ceramic ring during high temperatures encountered in plasma processing.

Claims 11, 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yatsuda et al (US Patent No. 6,488,863) in view of Chiang et al (US Patent 6,800,173) and Ramanan et al (US patent No. 6,529,686) as applied to claims 1, 2, 10, 12, 15, 16, 21 and 23 and further in view of Wang et al (US PGPUB No. 2002/0075624).

Regarding Claims 11, 22: Yatsuda et al in view of Chiang et al and Ramanan et al teach all limitations of the claim except the substrate support further comprising an elastomeric joint between the ceramic member and the heat transfer member, and an elastomeric joint between the heat transfer member and the electrostatic chuck.

Wang et al teach a plasma apparatus (Figures 1, 2, 6) comprising an electrostatic chuck assembly 55 that includes an electrostatic member 100 (electrostatic chuck) is bonded to base 175 (heat transfer member) by a ductile and compliant layer 250 (elastomeric joint). Wang et al also teach that base 175 is in turn bonded to support 190 (ceramic member) by a compliant and ductile material 295 (elastomeric joint) [paragraphs 0036, 0038, 0056, 0063, 0066].

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention use elastomeric joints for bonding ceramic member, electrostatic chuck and heat transfer member as taught by Wang et al in the apparatus of Yatsuda et al in view of Chiang et al and Ramanan et al to absorb thermal stresses arising due to different thermal coefficients of expansion of the interfacing materials (paragraph 0056).

Claim 19 is rejected under 35 U.S.C. 103(a) as being unpatentable over Yatsuda et al (US Patent No. 6,488,863) in view of Chiang et al (US Patent 6,800,173) and Ramanan et al (US patent No. 6,529,686) as applied to claim 15 and further in view of Mahawili (US patent No. 6,007,635).

Regarding Claim 19: Yatsuda et al in view of Chiang et al and Ramanan et al teach all limitations of the claim including that ceramic member 20 includes a recessed surface and a flange, and the heat

transfer member 18 is disposed on the recessed surface, and further the electrostatic chuck 28 contacts the flange of the ceramic member 20 (Yatsuda et al – Figure 1).

Yatsuda et al in view of Chiang et al and Ramanan et al do not teach heat transfer member is laterally spaced from the flange.

Though Yatsuda et al do not teach that worktable (heat transfer member) 18 is laterally spaced from the flange, but it would be obvious to do the same to allow for thermal expansion between the heat transfer member 18 (made from aluminum) and the ceramic member 20 at the high temperatures during wafer processing (examiner notes that applicant has not disclosed any criticality for such a gap). A supporting reference (by Mahawili) is also cited hereunder.

Mahawili teaches a substrate support apparatus (Figure 1) that includes a heater housing 22 with a support surface 21 in which a platform 10 (heat transfer member) is seated. Mahawili further teaches that heater housing 22 and platform could be made from dissimilar materials like ceramic and aluminum respectively. Mahawili also teaches that support surface 21 of heater housing 22 is sized to permit unrestrained radial thermal expansion of platform 10 (that is, platform 10 is spaced from ceramic heater housing){column 4, line 1 to column 5, line 20}.

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to provide a spacing between heat transfer member and ceramic member as taught by Mahawili in the apparatus of Yatsuda et al in view of Chiang et al and Ramanan et al to allow for thermal expansion between heat transfer member (metallic) and the ceramic member.

Claims 32, 33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Yatsuda et al (US Patent No. 6,488,863) in view of Chiang et al (US Patent 6,800,173) and Ramanan et al (US patent No. 6,529,686) as applied to claims 1, 2, 10, 12, 15, 16, 21 and 23 and further in view of Gaylord et al (US patent No. 5,849,076).

Regarding Claim 32, 33: Yatsuda et al in view of Chiang et al and Ramanan et al teach all limitations of the claims including that the controller 330 (in combination with flow controller 74) is operable to control the heating of heat transfer member 110 by controlling the temperature and flow rate of the liquid coolant flowing through flow passage 78 (e.g. Chiang et al – col. 22, lines 21-45). Further, Ramanan et al teach that the apparatus includes controllers that are agile enough to precisely and accurately control temperature of the workpiece through heating and cooling steps that would include temperature changes in steps and ramps (e.g. Figs. 6-9). Ramanan et al also teach that the controller is operable for heating or cooling rates of 1 degrees C/sec to 50 degrees C/sec.

Yatsuda et al in view of Chiang et al and Ramanan et al do not teach that controller is operable to circulate a liquid having a first temperature through the flow passage to control the temperature of the heat transfer member to a first temperature and also operable to circulate a liquid having a second temperature through the flow passage to control the temperature of the heat transfer member to a second temperature.

Gaylord et al teach a wafer processing apparatus comprising a liquid cooling system that circulates a temperature controlled liquid through a gas ring 18 with a coolant passage 84, for controlling its temperature. Gaylord et al further teach that the cooling system also includes a controller 90, a temperature sensor 92, a heat exchanger 76 and a coolant conduit loop 78 through which the coolant is circulated through passages 84 in the seal ring 18. Gaylord et al also teach that controller is able to control the temperature of coolant to first and second temperatures depending upon processing condition in the reactor (e.g. Figs. 1-3 and col. 5, line 50 to col. 7, line 40). It would be obvious to configure the controller in the apparatus of Yatsuda et al in view of Chiang et al and Ramanan et al to circulate liquid coolant with first and second temperatures as taught by Gaylord et al so as to enable the heat transfer member achieve first and second temperatures.

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to provide a controller that is operable to circulate a liquid coolant having first and second

temperatures as taught by Gaylord et al in the apparatus of Yatsuda et al in view of Chiang et al and Ramanan et al to enable control temperature of heat transfer member as per process limitations.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL.** See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Rakesh K. Dhingra whose telephone number is (571)-272-5959. The examiner can normally be reached on 8:30 -6:00 (Monday - Friday).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Parviz Hassanzadeh can be reached on (571)-272-1435. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Rakesh K. Dhingra

Karla Moore
Primary Examiner
Art Unit 1792